

**SOURCE WATER PROTECTION PROGRAM
BENEFITING THE TOWN OF BERLIN (PWSID 023-0001)
WORCESTER COUNTY, MARYLAND**

ALWI Project No. MD7S075

August 20, 2013

PREPARED FOR THE

TOWN OF BERLIN

**IN PARTIAL FULFILLMENT OF MARYLAND DEPARTMENT OF THE
ENVIRONMENT IFB SOLICITATION NO. U00R1400308**



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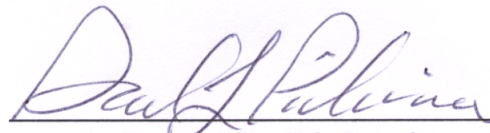
THE TOWN OF BERLIN

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TABLE OF CONTENTS
ALWI Project No. MD7S075

1.0	INTRODUCTION.....	1
1.1	PURPOSE	1
1.2	REGULATORY FOR SOURCE WATER ASSESSMENT.....	2
1.3	BACKGROUND INFORMATION	2
1.4	DELINEATIONS REMAIN UNCHANGED FROM 2004 SWAP	2
2.0	CONTAMINANT THREATS ASSESSMENT	3
2.1	STATE ENVIRONMENTAL DATABASE REVIEW	3
2.2	FIELD RECONNAISSANCE WITHIN WHPAS	4
2.3	POTENTIAL POINT SOURCE CONTAMINANT HAZARDS WITHIN SWPAs.....	4
2.4	POINT SOURCE CONTAMINANT HAZARDS OUTSIDE SWPAs	6
2.5	NON-POINT SOURCE CONTAMINATION HAZARDS AS SUGGESTED BY LAND USE....	7
2.6	CONTAMINATION HAZARDS OUTSIDE PUBLIC SEWER SERVICE AREAS.....	7
3.0	CONTAMINANT SUSCEPTIBILITY.....	7
3.1	PROCEDURES	8
3.2	NITRATE SUSCEPTIBILITY	9
3.3	METHYL TERTIARY-BUTYL ETHER (MTBE) SUSCEPTIBILITY.....	9
3.4	OTHER GROUNDWATER CONSTITUENTS	10
4.0	STEERING COMMITTEE INTERACTIONS AND RECOMMENDATIONS	10
4.1	SOURCE WATER PROTECTION ORDINANCE.....	10
4.2	DELIBERATIONS AND AGREEMENTS	11
4.3	RECOMMENDATIONS FOR SUPPLEMENTAL INVESTIGATION	12
4.4	PROTECTIVE RECOMMENDATIONS.....	12
5.0	REFERENCES	13

LIST OF TABLES, FIGURES AND APPENDICES
ALWI Project No. MD7S075

TABLES

- TABLE 1:** POINT SOURCE HAZARD INVENTORY
- TABLE 2:** LAND USE SUMMARY BY SOURCE WATER PROTECTION AREA
- TABLE 3:** GROUNDWATER SUSCEPTIBILITY BASED ON WATER QUALITY DATA (2004-2011)
- TABLE 4:** RECOMMENDED ORDINANCE REVISIONS

FIGURES

- FIGURE 1:** SOURCE WATER PROTECTION AREAS AND POINT SOURCE CONTAMINATION HAZARDS
- FIGURE 2:** LAND USE MAP
- FIGURE 3:** NITRATE CONCENTRATIONS IN TOWN WELLS (2004 - 2011)
- FIGURE 4:** MTBE CONCENTRATIONS IN TOWN WELLS (2004 - 2012)

APPENDICES

- A: 2004 TOWN OF BERLIN SOURCE WATER ASSESSMENT PLAN**
- B: PHOTOGRAPHS OF WELLHEADS**
- C: OCTOBER 22, 2012 REPORT OF UNDERGROUND STORAGE TANK CLOSURE**
- D: CHAPTER 106: TOWN OF BERLIN WELLHEAD PROTECTION ORDINANCE**

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1.0 INTRODUCTION

Advanced Land and Water, Inc. (ALWI) was engaged by the Maryland Department of the Environment (MDE) to assist 12 community groundwater systems, including Berlin (the Town), to develop and implement Source Water Protection Programs (SWPPs). These programs will help protect public health by identifying implementable measures to address existing and potential contaminant threats to groundwater supplies of safe drinking water.

In 2004, ALWI developed a source water assessment report for the Town (Appendix A). We updated this assessment for currency, following technical guidance received from the Water Supply Program of MDE. Notwithstanding this update, source water assessment is an intrinsically dynamic process. The currency of this assessment continuously is affected by new data, changing regulations and the evolving experience and professional judgment of those involved in developing and implementing this assessment and the recommendations herein.

The Town was and remains served by three supply wells located south-southwest of the intersection of US Routes 113 and 50, in northern Worcester County, Maryland (Figure 1). The previous effort also encompassed wells then in use for sanitary, potable and industrial purposes at the former Tyson Foods plant near the northern Town boundary. Although the Tyson plant since has closed and the Tyson wells now are used little if at all, both the Town and MDE preferred that the earlier delineations not change (i.e., contract) because a prospective new owner or tenant may be identified and may once again come to use the wells.

As future phases of our SWPP work proceed, a benefit or need for a further revision to this assessment may arise from MDE review comments, System preferences, citizen input or other reasons. If and as necessary, we will prepare a further update to this assessment, as a final contract activity.

1.1 PURPOSE

Maryland's Source Water Assessment Program (SWAP) was approved by the U.S. Environmental Protection Agency (EPA) in November 1999, and the initial source water assessment for the Town was completed in 2004. The 2004 SWAP included recommendations for ongoing management and protection, as well as periodic updates to reflect changes to the water system, appropriation permit and/or land uses within Source Water Protection Areas (SWPAs) as they may periodically occur. Note that in the 2004 report, SWPAs were termed "wellhead protection areas."

While this past effort recommended source protection and management concepts, MDE included the Town in our current work based on an agency perception of the ongoing vulnerability of its water system to potential groundwater contamination. Accordingly, the overall purpose of this work is to assist the Town in developing a SWPP, which includes specific guidance on implementing feasible source protection measures.

1.2 REGULATORY FRAMEWORK FOR SOURCE WATER ASSESSMENT

ALWI followed MDE's source water assessment and wellhead protection guidelines, which stem from The Safe Drinking Water Act (SDWA) of 1974 and its later amendments, which established wellhead protection programs for each state under the oversight of the EPA. The 1996 Amendments to the SDWA mandated that MDE develop a Source Water Assessment Program. In September of 2011, ALWI was awarded the SWPP contract. The Town's participation in the SWPP was voluntary and not a regulatory requirement under the SDWA.

1.3 BACKGROUND INFORMATION

The municipal water system for the Town (PWSID 023-0001) delivers approximately 500,000 gallons per day (gpd) to nearly 4,000 residents. The Town was and remains served by three production wells, all are completed in the Pleistocene Aquifers of the Atlantic Coastal Plain.

In 2004, ALWI furnished the following recommendations to support ongoing source protection:

- A draft wellhead protection ordinance, designed to restrict the future occurrences of incompatible land uses and activities;
- Periodic reviews and potential revisions to SWPAs to reflect possible changes in the magnitude and distribution of groundwater withdrawals;
- Triennial updates of the contaminant hazard inventory; and
- Programmatic community awareness and public outreach measures.

One of our project goals was to review the data from these monitoring reports to develop and refine recommendations to reduce the risk and concentration of potential contamination according to MDE guidelines. The SWPP effort now underway updates the earlier MDE recommendations based on available data and applicable regulations and guidelines.

1.4 DELINEATIONS REMAIN LARGELY UNCHANGED FROM 2004 SWAP

In 2004, ALWI delineated two SWPAs (then also termed wellhead protection areas) based on differential travel times. Zone 1 represented an estimated 1-year time-of-travel, and Zone 2 represented an estimated 10-year time-of-travel modeled in accordance with MDE guidelines with the results then approved by the Town and the agency. Interpretively, contaminant releases within Zone 1 would be of greater concern considering the relative immediacy of a water quality effect. Zone 2 releases are somewhat less concerning because of the greater time for a response

and the effects of dilution and attenuation with distance.

Three Zone 1 areas encompass immediate areas around each of the three Town wells, with one of those Zone 1 areas (the one associated with Town Well 2) also encompassing the Tyson wells. Zone 2 represents an aggregate overlap of individual potential flow pathways, and generally extends west of Town into the County (Figure 1). For this update iteration, updates to SWPAs were not necessary because:

- Tyson wells, though temporarily inactive, remain included for conservatism as aforementioned;
- No new sources were added to the System;
- System pumpage distributions (i.e., well by well withdrawals) were not altered; and
- There has been no change to the Town water appropriation permit since 2004.

With the increased spatial resolution from the use of differentially-correcting global position system (GPS) equipment, the locations of the wells have been refined¹, resulting in a slight spatial shift of the SWPA for Well 1 (Figure 1). Previous delineation methods are summarized in Appendix A.

2.0 CONTAMINANT THREATS ASSESSMENT

ALWI performed regulatory database reviews, field reconnaissance and limited interviews to update the 2004 inventory of potential sources of contamination within the SWPAs. We considered both point and non-point sources of contamination.

2.1 STATE ENVIRONMENTAL DATABASE REVIEW

MDE provided ALWI the following state-maintained environmental databases to incorporate into point-source hazard inventories, with the date of database publication provided parenthetically as follows:

- Municipal and Industrial Groundwater Discharge Permits (12/21/2011);
- Pesticide Dealers (1/12/2012);
- Land Restoration Program Sites (Voluntary Cleanup Program and Comprehensive Environmental Response, Comprehensive, and Liability Act) (1/16/2012);
- Oil Control Program (OCP) Underground Storage Tank (UST) and Leaking UST Databases (10/14/2011);

¹ Previous GPS coordinates reflected purposeful errors for reasons of national security. Current ALWI GPS equipment has sub-meter accuracy.

- ❑ Supplemental database listings of solid waste facilities, wood waste disposal sites and other hazardous waste generators (2/2012); and
- ❑ Resource Conservation and Recovery Act sites (6/18/2012).

The databases helped with interpretations of groundwater susceptibility, in that the listed facilities may be generators of hazardous materials, petroleum products and/or other drinking water contaminants. Results of this review are integrated with the susceptibility discussion in Chapter 3 of this report.

2.2 FIELD RECONNAISSANCE WITHIN SWPAs

ALWI supplemented the database review by performing a visual reconnaissance within the SWPAs on January 13, 2012. Results of this updated inventory are displayed on Figure 1 and summarized in Table 1.

During this reconnaissance, local land use conditions were observed with emphasis on the potential use, storage and disposal practices of hazardous materials and petroleum products within the delineated SWPAs. Such conditions may have included visual evidence of present or former spills, stained or discolored ground surfaces, stressed vegetation, unusual odors or visible underground storage tank facilities. Adjacent and nearby properties were visually scanned to the degree practicable from public rights-of-way.

No significant land use changes since 2004 were noted. Note that in addition to the continuing point-source and non-point hazards discussed in this Chapter, other contaminant hazards may exist that remain undetected because of limitations in the methods employed (concealed visual evidence, etc.) and/or (2) new contamination hazards may develop in the future.

The Town's production wells appeared to possess good physical integrity; subsurface or invasive work of a confirmatory nature was not a component of the scope for this contract. During our January 13, 2012 field reconnaissance, we did not observe evidence of direct contamination emanating from areas immediately surrounding the wells.

Photographs of each wellhead are provided in Appendix B. Space heaters exist in all the locked well-house buildings along with bags of soda ash stored on wooden pellets. In addition, a drum of hypochlorite (bleach) was stored within the well-house for Well 2.

2.3 POTENTIAL POINT SOURCE CONTAMINATION HAZARDS WITHIN SWPAs

On January 13, 2012, we observed the continuing existence of the following potential point source hazards, originally identified in 2004 (Figure 1). Note that omitted from this list are 2004 database entries without corresponding 2012 observations:

- A. **Cheers/Alpha Beverages/Ocean Petroleum** - In 2004, ALWI observed visual evidence of underground storage tank (UST) use at the typically functioning gas station (with a liquor

store inside). On-site USTs are located approximately 800 feet west of one of the Tyson wells. The MDE Oil Control Program database indicated that two 10,000 gallon gasohol (gasoline with up to 10% ethanol added) tanks are still in use. Seven previous USTs holding kerosene and gasoline have been removed. As in 2004, no visual evidence of monitoring or remediation could be observed. An open MDE Oil Control Program case remains for the site.

- B. **Former Tyson Foods Plant** - In 2004, ALWI observed two 275-gallon aboveground storage tanks. One of these tanks was placarded as containing kerosene while the other held waste oil. The MDE Oil Control Program database indicated that two 2,000 gallon heating oil tanks were closed in place in 2003 and 2004. The MDE Land Restoration Program database indicated that a voluntary cleanup occurred and a “no further requirements” determination was granted in 2005.
- C. **Venable's Cleaners/Marion's Used Furniture Store** - Venable's Cleaners is a dry cleaning facility with classical solvent-based garment cleaning and processing on premises. In 2004, one large aboveground storage tank was observed at the rear of the property with the word “DANGER” written across it. The MDE Oil Control Program database indicates the closure of several USTs in 1999 or before.
- D. **Former Evans Dump Site** - In 2004, ALWI observed an informal refuse disposal area on a property owned by Royce W. and Barbara M. Evans, directly west of Tyson Foods, within the western periphery of Zone 1A. No continuing evidence of widespread refuse disposal was observed at this location in 2012.
- E. **Seitz Automotive** - In 2004, a dark fluid was observed to emanate from the garage area and flow across the land surface to a shallow gully between the Seitz and Tyson properties. Several 55-gallon drums could be observed commingled with vehicles and junked vehicle components behind the building. Late during the course of its work, ALWI received anecdotal reports that this facility formerly may have been used for the retailing of gasoline. Despite this, then as now the MDE Oil Control database does not list USTs at this location. ALWI did not observe releases during the 2011 field reconnaissance.
- F. **Berlin Volunteer Fire Company** - In 2004, ALWI observed possible UST vents at the Berlin Volunteer Fire Company located at 214 N. Main Street. The MDE Oil Control Program database indicated that the 550 gallon diesel UST was removed in 1999, while a 1,000 gallon heating oil UST remains in use. Our 2011 observations were unchanged.
- G. **Wainwright Service Station** - In 2004, ALWI noted automotive service operations occur on-site, with a record of both open and closed USTs. The MDE Oil Control Program database indicated that two 8,000 gallon gasohol USTs are in use.
- H. **Worcester County Library (Berlin Branch)** - The MDE Oil Control Program database indicated that a 2,000 gallon heating oil UST was removed in 2011.
- I. **Delmarva Oil Company** - The MDE Land Restoration Program database listed this site based on the release and subsequent investigation of liquid-phase floating hydrocarbon (“free

product”). The release to groundwater was first detected in 1984. As of 1991 free phase petroleum (both weathered gasoline and fuel oil) had accumulated to a thickness of one foot. A 1991 report in MDE files opined “...that the product thickness was increasing over time, that a continuing source of product existed, and that groundwater at the site flows in a southwesterly direction...,” which is away from the Berlin and Tyson wells. No further information was discernible from our 2012 field reconnaissance.

- J. Former Sewage Sludge Application Area** - Town officials notified us that a landowner partially within, but largely northwest and just outside of SWPA Zone 1A, formerly applied sewage sludge to his fields, which had been accepted from Ocean City. The land application of sewage sludge may potentially introduce nitrate into the groundwater, which could be captured by Well 2 within a few years. At the time of our follow-up inquiry in December 2012, a representative of the Town SWPP Steering Committee advised that the practice of accepting sewage sludge at this location has been discontinued.

Though not discernable by direct visual observation in 2012, the Town also advised of the successful removal and closure of a former gasoline UST near Well 3 (Appendix C). Soil contamination detected during this removal action remained below regulatory action criteria. Notwithstanding this finding, in part because of the observed shallow depth-to-groundwater and the evidence for a former release, some measure of low-concentration groundwater contamination arising from past releases from this former UST may be present in the shallow, unconfined aquifer.

Based on the reported, probable age of the UST (approximately 40 years), the period of its active use may predate the widespread commercial availability of MTBE as a fuel oxygenate. Most importantly, the spatial position of this UST (near Well 3) does not explain persistently elevated VOCs detected in Well 2.

2.5 POINT-SOURCE CONTAMINATION HAZARDS OUTSIDE SWPAS

During the course of the SWPA update and SWPP development effort, both the Town and MDE advised of various VOC contamination releases in the greater Berlin region but outside of the delineated SWPAS.

The locations of these releases and related investigations generally are along the US-50 corridor (e.g., State Police Barracks and “Muriel Select” and “Ocean Downs Raceway” among others) and beyond the outer extent of the Zone 2 SWPA delineation. Others may exist, as well. That Berlin is understood to have elected to extend public water to Muriel Select and the Police Barracks does not increase the threat posed to Berlin’s wells nor does it support a conclusion of regional VOC susceptibility.

Absent detectable concentrations of non-MTBE VOCs in the Berlin wells, and absent clearly increasing trends of MTBE in these Town production wells, ALWI did not find basis to conclude that the surficial and/or Pleistocene aquifer possesses regional VOC susceptibility.

2.6 NON-POINT SOURCE CONTAMINATION HAZARDS AS SUGGESTED BY LAND USE

MDE guidance suggests consideration and mapping of the municipal sewer service area and the following classifications of land use within the wellhead protection delineated areas: agriculture, forest, residential, industrial, commercial, public lands and mined lands. Each of these has potential implications in terms of non-point contaminant sources (e.g., septic systems outside public sewer service areas and leaking mains inside said areas).

ALWI obtained 2011 land use Geographic Information System data for the SWPA for these and other related land uses, as well as the present municipal sewer service area (Figure 2) from the Maryland Department of Planning.

Pertinent land use acreages and percentages by SWPA are listed in Table 2. Dominant land uses within the SWPAs are agricultural lands (Zone 2), low to medium density residential (Zones 1A, 1B and 1C) and industrial lands (Zone 1A). Relatively small areas are in commercial, institutional and forested uses (Table 2).

2.7 CONTAMINATION HAZARDS OUTSIDE PUBLIC SEWER SERVICE AREA

Property owners and occupants outside of the sewer service area may contribute to groundwater contamination differently than those on public sewer:

- If residents in unsewered areas discharge wastes into their septic systems, they are more likely to enter the groundwater and contaminate the water source.
- Agricultural land may be fertilized or treated with herbicides.
- Liquid petroleum products commonly are used as a heating fuel.
- The generation, storage and discharge of hazardous wastes and other regulated liquids is incidental to many commercial and industrial land uses and activities outside public sewer service areas.

3.0 CONTAMINANT SUSCEPTIBILITY

ALWI completed a review of available groundwater quality records, integrated with other findings herein, to support an assessment of groundwater susceptibility. MDE guidance defines a threshold for regarding a water source being “susceptible” to a given contaminant as being either:

- When the concentrations exceed 50% of the MCL for 10% or more of the documented samples for a regulated contaminant and/or
- When a persistent but lower concentration is either increasing or chemically appears associated with an unknown or unexpected source.

In addition to these water quality data considerations, ALWI also considered the following factors in evaluating overall susceptibility:

- ❑ The spatial position of sources of potential contamination relative to sources and SWPAs;
- ❑ Observed conditions of wellhead integrity and treatment supplies management; and
- ❑ The natural chemical properties of the source water within contributing aquifers.

3.1 PROCEDURES

ALWI completed the susceptibility assessment in accordance with the following step-wise procedure:

1. **Obtain and Filter Water Quality Databases** - ALWI reviewed available electronic databases of water quality analyses provided by MDE for the period 2004 to 2011. The available water quality records only reflect post-treatment, water samples and not raw groundwater conditions. As such and despite the fact that each well is screened in the Pleistocene aquifer, mixing, blending and treatment efficacy is reflected in the water quality results as furnished to us. Important spatial variability in the differential exposure of each well to manmade point sources may not be reflected (or not fully reflected) in the water quality databases. Generally the absence of comprehensive analytical results of raw groundwater samples hampered correlating specific water quality findings to natural conditions (i.e., before treatment) within contributing SWPAs and SWAP sub-regions.
2. **Consider Chemical Classes and Sampling Conditions** - The furnished databases were developed by MDE as an incidence of operational compliance record-keeping. They contained analytical records for inorganic compounds (IOCs) including radiological species, volatile organic compounds (VOCs) and synthetic organic compounds (SOCs). The raw databases were filtered to isolate only contaminants, within the chemical classes identified in applicable MDE guidance, prospectively originating from Town groundwater supplies rather than originating as a byproduct of treatment processes.
3. **Identify “Exceedance” Instances** - To identify water quality sample exceedances, we compared each specific analytical result to published MCLs (in COMAR 26.04.01 as of September 2011). Guided by MDE, we judged that a concentration greater than or equal to 50% of a given MCL should be considered an “exceedance.” Procedurally, this was accomplished by sorting the database by analyte and concentration.
4. **Assess Frequency and Relative Percentage of Exceedance Instances** - The number of times that a given analyte was detected in a concentration greater than 50% of its respective MCL was discerned in terms of overall frequency, percentage of total number of samples and date range of exceedance. Contaminants with results equaling or exceeding 50% of the MCL more than 10% of the time were considered *prima facie* susceptible. ALWI also identified changes in contaminant trends over time, even for those that did not equal or exceed 50% of the MCL more than 10% of the time.

5. **Integrate Information** - ALWI then considered these identified exceedances in the context of the results of the contamination hazard reconnaissance to correlate water quality results to specific field observations suggestive of a condition of susceptibility.

Berlin Wells 1, 2 and 3 are located near Williams Street, Franklin Street and Branch Avenue, respectively. "Plant ID" designations reflected in the MDE database are believed to follow suit.

3.2 NITRATE SUSCEPTIBILITY

ALWI interpreted continuing nitrate susceptibility, similar to 2004. This condition remains due to the presence of contaminant sources in the SWPA (Figures 1 and 2) and the presence of elevated nitrate concentrations in recent samples (Figure 3).

Agricultural land uses, septic tank leakage, sewage leakage, natural erosion and certain point sources may contribute nitrate to the environment and thus to the shallow groundwater supply wells. Concentrations of nitrate in the distribution system exceed the 50% MCL threshold in between approximately 20% and 30% of the time.

3.3 METHYL TERTIARY-BUTYL ETHER (MTBE) SUSCEPTIBILITY

ALWI interpreted continuing MTBE susceptibility, similar to 2004. This condition remains due to the presence of contaminant sources in the SWPA (Figure 1) and the continuing presence of elevated MTBE concentrations (Figure 4). MTBE is a gasoline additive that aids in combustion and currently has an action level of 20 µg/L.

Concentrations at the Williams Street well (Well 1) have increased since 2004 and exceeded 12 µg/L (more than 50% of the MCL) in 2012. No clear explanation for this sudden increase in MTBE concentration was afforded by our field reconnaissance or other information available. Several properties near Well 2 and more generally, throughout downtown Berlin, may have possessed USTs that contain or contained gasoline based on a combination of their architecture and historic records.

The Cheers / Alpha Liquors / Ocean Petroleum site is unique in possessing a combination of conditions supporting our 2004 and continuing interpretation that this site is a potential source for the MTBE affecting Well 2. It is located in the SWPA Zone 1, retails petroleum and remains an open MDE Oil Control Program case site. No other identified source possesses this combination of contributing factors to support an interpretation of the likely source of contamination of Well 2.

MTBE sometimes occurs in association with other VOCs, particularly gasoline constituents. The present and continuing finding of MTBE susceptibility may indicate that other VOCs also have been released and the development of a future condition of susceptibility to these other VOCs also is possible.

3.4 OTHER GROUNDWATER CONSTITUENTS

We did not otherwise find the Town's system susceptible to other groundwater contaminants of natural or anthropogenic origin (Table 3), supported as follows:

- ❑ **Other Inorganic Compounds (IOCs)** - Barium and chromium were detected in very low levels, not exceeding the 50% MCL threshold. Low concentrations of arsenic were found in one of four samples from Plants 01 and 03 (Wells 2 and 3). Subsequent sampling at both plants did not detect measureable arsenic concentrations.
- ❑ **Radionuclides** - The source of radionuclides in groundwater is the natural occurrence of uranium in the aquifer formations. Radionuclides were not detected above 50% of an MCL. Gross Alpha and Gross Beta were detected in low concentrations, however. The source of gross alpha in groundwater is the natural occurrence of radioactivity in the aquifer formations, including uranium. Gross beta is attributed to a multitude of other naturally occurring radionuclides, including potassium and radium.
- ❑ **Benzene** - This volatile organic compound was detected in 2005 at the Franklin water treatment plant (Well 1), though it did not exceed the 50% MCL threshold. In the subsequent samples, benzene was below the detection limit. Sampling and/or laboratory error in 2005 seems possible. Benzene is a gasoline constituent and as such, the possibility of future benzene susceptibility cannot be eliminated because MTBE susceptibility persists.

4.0 STEERING COMMITTEE INTERACTIONS & RECOMMENDATIONS

Berlin convened a Source Water Protection Steering Committee comprised of select Town officials. Steering Committee members included:

NAME	AFFILIATION
Jane Kreiter	Town of Berlin
Tony Carson	Town of Berlin
Gee Williams	Town of Berlin
David Gaskill	Town of Berlin
Marvin Smith	Town of Berlin
Joseph Everd	MD Rural Water Assoc.

Ms. Kreiter and Messrs. Carson and Everd participated in the first Steering Committee meeting, on Friday, March 23, 2012. Only Ms. Kreiter participated in the second meeting, on December 6, 2012.

4.1 SOURCE WATER PROTECTION ORDINANCES

In 2004, the Town adopted Ordinance Number 2004-05, a wellhead protection program that is similar in overall scope to the MDE Model Wellhead Protection Ordinance. In 2011, the Town modified Chapter 106 of the Town Code, to provide for privately owned geothermal and irrigation wells within the delineated protection zones (Appendix D). We have reviewed both

documents and offered specific recommendations for consideration by the Town Steering Committee (Table 4) including:

- ❑ **Single Ordinance and Code Chapter** - We believe clarity would be improved if a single ordinance and code chapter existed to represent the sum total of allowed uses, conditional activities and prohibited operations within each of the two zones. Such an update also would allow for a general review of applicable language for conciseness, parallelism and the use of present terminology (e.g., source water protection rather than wellhead protection).
- ❑ **Geographic Range of Applicability** - The Town Ordinance covers the subset of the corporate limits also within the delineated SWPA. ALWI recommended that the Town request the County to adopt a parallel and functionally identical ordinance covering County lands within the SWPA. The Steering Committee deferred contacting the County to make such a request.
- ❑ **Wells and Groundwater Uses Within the SWPAs** - A 2011 ordinance now expressly allows geothermal and irrigation water uses within the SWPAs. Ideally the water supply would be penetrated by as few wells as possible; any such infrastructure is a potential downward path for contaminant migration. ALWI recommends that the water supply be protected by requiring geothermal and irrigation well screens not to be set more shallowly than the probable base of the drinking water aquifer. The 2011 ordinance endeavors to achieve this, but imperfectly.

Town representatives came to take these recommendations under advisement, as well as the others summarized in Table 4. No action is contemplated during the period of our SWPP contract with MDE.

4.2 DELIBERATIONS AND AGREEMENTS

The Steering Committee supported the SWPP effort with certain reservations. After discussion, the Steering Committee came to agree on the following:

1. **Delineations** - The Steering Committee and MDE both felt that the delineated areas should remained unchanged even though the Tyson wells were not in active use at the time of this SWPP development.
2. **Ordinance Revisions** - As detailed in Section 4.1, the Steering Committee came to judge it in the Town's overall best interest not to request the County to enact a comparable ordinance covering SWPA lands outside Town jurisdiction.
3. **Community Involvement and Public Workshop** - The Steering Committee was concerned about possible negative publicity for matters such as "susceptibility" and its less than full acceptance of our protective recommendations. No workshop came to be convened as a consequence.

4.3 RECOMMENDATIONS FOR SUPPLEMENTAL INVESTIGATION

Ocean Petroleum / Alpha Cheers remains the most plausible source for historic and ongoing VOC susceptibility (benzene and MTBE) within Berlin Well 2 and Tyson Well 1. No new information contravened the fact patterns and professional opinions we reached in 2004. Town officials reported a general tendency toward increased VOC concentrations in Well 2 since Tyson ceased active operations, suggesting that the operation of Tyson Well 1 protected Berlin Well 2 from the full extent of VOC groundwater contamination.

Only Ocean Petroleum / Alpha Cheers possesses the combination of past gasoline releases to soil and groundwater, less than fully remediated conditions, continuing UST fuel storage and spatial positioning to fully explain the occurrence, history and areal extent of contamination. Whether another source(s) exists or existed in the area remains possible, but unconfirmed. Chapter 6 of the 2004 Source Water Assessment (Appendix A) speaks to our then-interpretation of Ocean/Petroleum / Alpha Cheers as the MTBE source.

The source of MTBE detected in Berlin Well 1 defies ready explanation. For now, we recommend re-sampling to rule out the possibility of sampling or laboratory error. The detection of this contaminant in Well 1 at concentrations considerably higher than elsewhere presently or historically, suggests a fresh and/or nearby release but doubtfully implicates Alpha Cheers because Well 2 is positioned where it also would be affected and to a greater degree. If re-sampling confirms the elevated finding of approximately 12 µg/L, another source seems potentially present, probably situated near Well 1, and this would warrant investigation. In such a circumstance, we would suggest that Berlin consider contacting the MDE Oil Control Program for assistance.

4.4 PROTECTIVE RECOMMENDATIONS

The citizens benefit the most from the Town and County both adopting the Ordinance revisions outlined in Table 4. ALWI recommends that the Town reconsider its decision not to ask the County to embrace and adopt an ordinance throughout the SWPA.

In addition to the Ordinance recommendations and the chemical hazard reduction strategies identified in Chapter 6 of the 2004 Source Water Assessment (Appendix A), below is a list of other protective recommendations, again presented in decreasing order of our present sense of their relative importance, implementation feasibility (including cost) and benefit. The need and order of these easily could change based on investigative findings, available funding and the input of MDE and other parties.

1. **Agricultural Outreach** - We see potential benefit in financial incentives (including but not necessarily restricted to property tax reductions) offered to property owners of CAFOs and other farms, for their proactive and voluntary cooperation in planting trees, rotating crops, and otherwise changing land management practices in a way that results in improved Town water quality. The implementation of such a program would require careful planning and ongoing public relations to be successful in the long-term. Also, the concurrence and active assistance of the County would be needed for effective implementation because much of the Town's source water originates in County jurisdiction.

2. **Acquire or Ease Specific Properties** - Absent other beneficial results and assuming the availability of financial resources, the Town could consider acquiring and/or granting easements with respect to specific properties to lessen the likelihood of existing or potentially incompatible land uses. The possibility of acquiring Ocean Petroleum / Alpha Cheers (or doing a land swap) would address several interrelated concerns.
3. **Extend Service Areas to Annexed Properties** - The Town should extend water and sewer service throughout Zones 1 and 2, possibly as well as other annexed/purchased areas. Once this is achieved, private wells and septic systems should be abandoned. This would help prevent future short-circuiting of contaminants into the source aquifer(s) by way of obsolete domestic wells, as well as limit non-point nitrate (and other) contamination associated with relict septic systems.
4. **Post “No Dumping” Signs Within SWPA** - The Town and County should consider posting “No Dumping” signs at various locations within the SWPAs to discourage the informal disposal of hazardous wastes and petroleum products. Similarly, the City and County periodically should examine the SWPAs for evidence of dumping, while removing unwanted debris and waste items at the same time.

5.0 REFERENCES

- Advanced Land and Water, Inc., Source Water Assessment for Berlin, Worcester County, Maryland. May 27, 2004.
- MDE. *Delmarva Oil Company, Berlin Plant*. MDE, n.d. Web. 1 Feb. 2012. <http://www.mde.state.md.us/programs/Land/MarylandBrownfieldVCP/mapping/Documents/www.mde.state.md.us/assets/document/brownfields/Delmarva_Oil_Berlin.pdf>.